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A System for Air Pollution Detection

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Abstract: ***We, humans always like to spend most of our time in indoor area. Hence, indoor air quality is a prominent reason for increasing health concern nowadays. The effect of poor indoor air quality on an individual can vary greatly based on their age and relative health. So, a technique is proposed here, to determine and ensure the quality of air we breathe. Real Time Air quality monitoring system will monitor the level of gases, dust and temperature rise in atmosphere and provides a detailed information about the unusual changes in your surroundings. The proposed system will detect gases like Methane(CH4), Carbon Monoxide(CO), Hydrogen(H2), LPG, Alcohol, Smoke and dust particles, temperature and humidity. It will alerts the user through a mobile application and gives an overview about the surrounding air using the previous records and estimated real time values. Main platforms used here are Arduino for hardware programming which connects via wifi or Bluetooth to server using ESP32.***

Key words: Arduino, ESP32*.*

I. INTRODUCTION

Most of us spend much of our time indoors. The air that we breathe in our homes, schools and offices can put us at risk causing severe health problems. Some pollutants can be chemicals, gases and even living organisms like mold and pests.

The main source of pollution are mainly homes, schools and offices. Some pollutants cause health problems such as sore eyes, burning in the nose and throat, headaches, or fatigue. Other pollutants cause or worsen allergies, respiratory illness(such as asthma), heart disease, cancer and other serious long-term conditions. Sometimes individual pollutants at high concentrations, such as carbon monoxide, which can cause even death.

Usually the most effective way to improve indoor air quality is to eliminate individual sources or reduce their emissions. But how you will recognize the unexpected rise in your surroundings?

The system which we proposed here is about an indoor air quality checker which will determine the changes in air quality and alerts the user, if an unusual rise found.

The system composed of various sensors like dust, temperature, and gas communicates through arduino board. The sensed values are sent to server from where the user receives. It will automatically alerts the user if the surrounding environment of the devices is worse. The user interaction of system is through a mobile application.

II. STAGES OF BUILDING SYSTEM

A. Hardware/ Data source

This section is responsible for the source of data. Hardware part consists many sensors for determining air quality. These may include dust sensor, gas sensor, and temperature sensor. The specifications for each sensors are:

1) *Dust Sensor (gp2y1010au0f kg017):*The specified one is accurate for determining dust particles. Values mostly ranges from 0-1 in which 0 indicates the absence of dust and 1 indicates that dust is maximum. It detects the reflected light of dust in air. It is effective to detect very fine particle like cigarette smoke. Consumes less current(max 20mA). It can also enables to distinguish smoke from house dust.
2) *Gas Sensor (MQ 02):*Senses the toxic gases found in the atmosphere. It mainly senses LPG, methane, smoke, alcohol, hydrogen and so on. Values of each gas varies accordingly. High sensitivity to combustion gas in wide range. It is having long life and low cost
3) *Temperature/Humidity Sensor(DHT 11):* As the name 'Digital Temperature & Humidity' suggests the sensor senses temperature and humidity. The sensor uses exclusive digital-signal acquisition technique on temperature and humidity sensing technology, it ensures high reliability and excellent long term stability
4) *NodeMCU:* The values from the nano needs to be transmitted to server. This is possible using another device known as NodeMCU which helps in connecting to internet. The NodeMCU which we are using here is a dual core processor ESP32. Dual core is more reliable in data transmission. One processor is busy with connection setup to internet while at the same time the other one is performing data transmission. Hence, this is more reliable in data transfer.

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B. Server/ Data Storage

Server mainly composed of databases. This database stores values from the sensors. For this system we are using an Apache server. The database used here is SQLite. The user interface is through an android application. Hence, for android application the better database is SQLite. Server side is written in nodeJS. Database maintains the sensor values and are updated with real time values.

C. Mobile Application

User can receive the real time values of air quality determiners through a mobile application. The application can be written in android for android apps. The user gets an alert when the sensed values rises than threshold values. These threshold values are set by the administrator after considering the normal conditions of air at that particular area.

III.SYSTEM ARCHITECTURE

A. Air Quality Detection

The air quality detection part consists of various sensors which detects the current air quality of the atmosphere surrounding the system. These values detected are then fed to the microcontroller which transmits it to the server.

In order to measure the dust density the main equations used are:

calc_vol= meas_vol(5.0/1024)

dust_density=0.17*calc_vol-0.1

where calc_vol stands for calculated voltage, meas_vol is the measured voltage.

B. Retrieval of Data using a mobile app

The android app, when the user signed in, sends a get request to the server. The server then acknowledges the request by sending the data as a response. Once a user register and signed in then he/she will always be provided with the values that determine air quality of their surroundings. This service is only provided when the user is having internet facility in their mobile.

C. Comparison With Threshold Values

Default threshold, which is already set in the android app, is used to compare with the sensed values. These values are set by the administrator when the user gets registered into the application. The device sends the location of the user to server at the time of registration.

D. Concept Of Machine Learning

The average temperature and dust values of a particular month is calculated and came to a conclusion on air quality achieved on that month. Hence it gives an awareness to citizens about the quality of air they breathe.

After one month, the registered user gets advices on ‘how can you contribute to the betterment of air to ensure quality’.

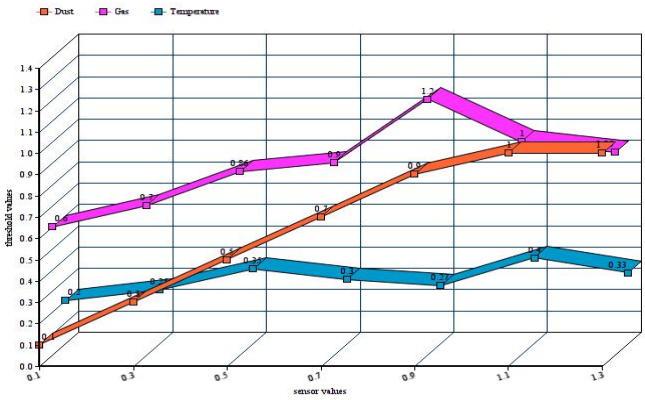

Fig. 1 System detects

The fig shows the generic estimation of air pollution index of the system. It mainly focuses on the calculated values of sensors such as dust, temperature, and gas. These sensor values are plotted against a threshold values which is set by the administrator based on the atmospheric conditions present on a city. The intensity of pollution depends on the prominent raise from the threshold values.

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Values of dust sensor ranges from 0.1 to the maximum value of 1(shows the dust is maximum). Gas sensor values also seems to be doubled than that of the threshold. The temperature value is least varied between the threshold 0.2 and 0.33.
We can arrive at a conclusion that the dust and pollutant gases adversely affect the current air quality which screams a status that will put your health in dilemma.

IV. CONCLUSION

To live a healthier life we have proposed a system which is based on IOT where it consists of various sensors to sense the levels of harmful gases, dust particles, temperature and humidity. This data will be transferred to users to their smart phones, smart devices or web pages. Alerts and notifications will be given to user to take preventive measures against indoor air conditions surrounding them. The system also determines the atmospheric conditions of an area by analyzing the recorded sensor values. It is better to know our indoor environment where we spend most of the time and monitor the quality of the air that we breathe. This is a small initiative towards a world where we can breathe without oxygen masks and harmful diseases.

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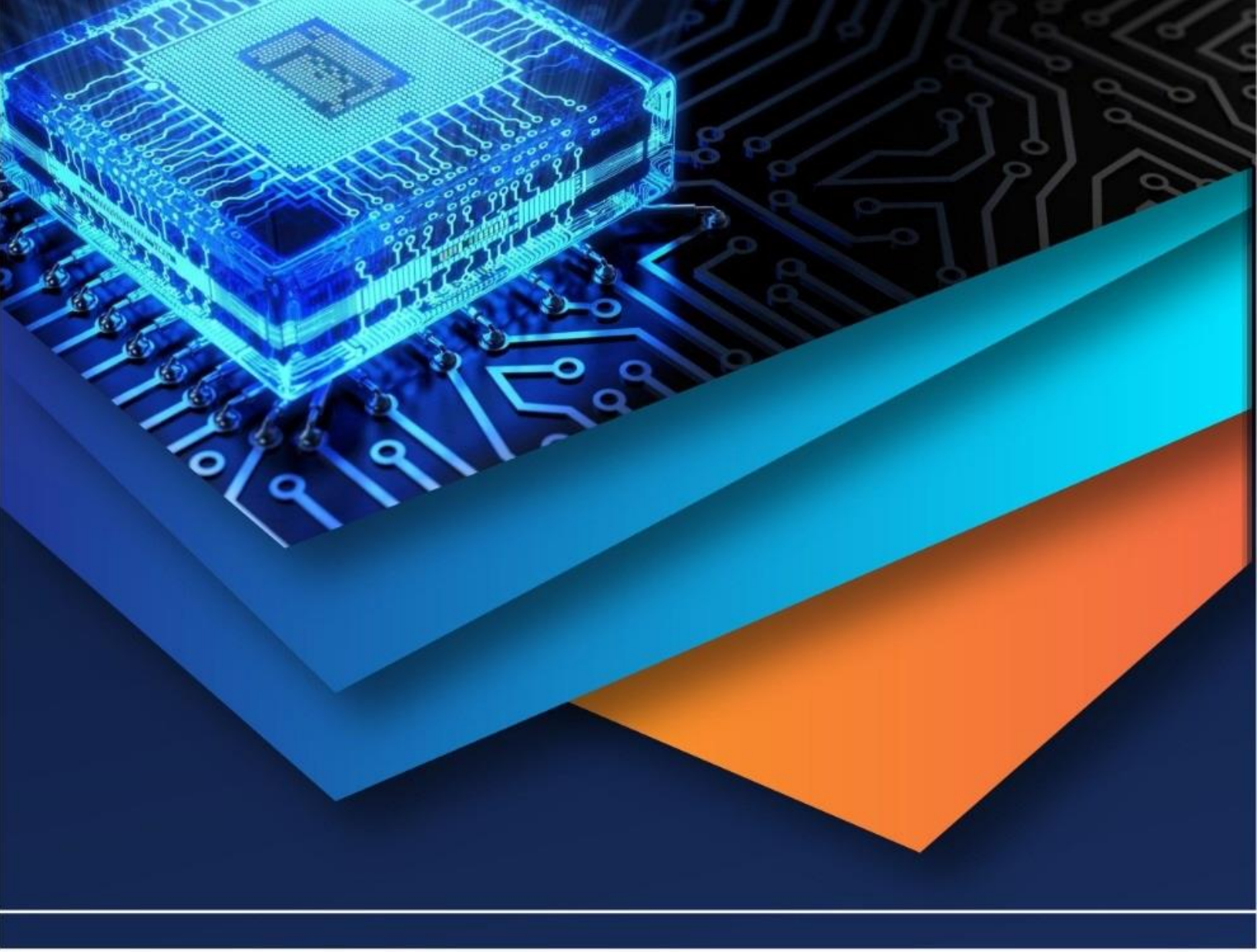

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